Persistence and Survival in Entrepreneurship: The Case of the Wave Energy Conversion Corporation of America

Giles Jackson
Randy Boxx

Many entrepreneurial firms risk falling into a cash flow "Valley of Death"—the stage of a young firm's life when seed funding is running dry but the firm has yet to secure sufficient additional funding to carry it through to product commercialization. This is particularly true in the nascent cleantech sector, where investments are often complex and capital intensive. Drawing on an in-depth interview with seasoned entrepreneur Brian Cunningham, CEO of the Wave Energy Conversion Corporation of America, this article explores the role of persistence in entrepreneurship, distinguishing between "calculated" and "blind" persistence.

Keywords: entrepreneurship, entrepreneurial traits

Worldwide almost $2 billion was invested in the Q1 2010 in companies working on renewable energy and efficiency projects—a figure approaching the level of the boom times before the financial crisis hit. However, this number is skewed by a large infusion of capital from government stimulus programs (Gelles and Waters, 2010). These funds were given to a relatively small number of projects. In the United States, for example, the ARPA-E (Advanced Research Projects Agency-Energy) program, which supports very early stage technologies, allocated its first round of grants totaling $151 million to just 37 projects, out of a pool of 3,600 applicants. Of the remaining 3,563 candidates, those most likely to be funded in this difficult environment are not big, complex, and capital-intensive power generation projects such as wind power, but efficiency companies that do more with less. This leaves the majority of firms in danger of falling into the "Valley of Death"—the stage of a young firm's life when seed funding is running dry but the firm has yet to secure sufficient additional funding to carry it through to product commercialization. According to Gompers and Lerner (2001, p. 21): "Ninety percent of new entrepreneurial businesses that don't attract venture capital fail within three years." What is it about the remaining 10 percent that enables them to endure beyond three years? We sought insight into this question by speaking with Brian Cunningham, CEO of the Wave Energy Conversion Corporation of America (WECCA), a nascent cleantech company that has failed to obtain funding for a second-generation prototype for more than five years, yet so far has managed to cheat death. According to Cunningham, the key to beating the odds is calculated persistence—a term we shall revisit later in this article. Leading thinkers have long extolled the virtue of persistence in any realm of life.

- "Permanence, perseverance and persistence in spite of all obstacles, discouragement, and impossibilities: It is this, that in all things distinguishes the strong soul from the weak."—Thomas Carlyle.
- "No great achievement is possible without persistent work."—Bertrand Russell.
- "Let me tell you the secret that has led me to my goal: my strength lies solely in my tenacity."—Louis Pasteur.
- "Many of life's failures are people who did not realize how close they were to success when they gave up."—Thomas Edison.
- "Never give in—never, never, never, never, in nothing great or small, large or petty, never give in except to convictions of honour and good sense."—Winston Churchill.

Persistence is also thought to be essential to business success, so much so that the *Oxford Dictionary*'s definition of the term supplies the following example: companies must have patience and persistence, but the rewards are there. Wu et al. (2007) found that the need for achievement is positively related to persistence, but surprisingly, few studies have directly addressed the role of persistence in entrepreneurship. Analysis of in-depth interviews with seasoned CEOs such as Cunningham may yield greater insights into the role of persistence in entrepreneurial survival. The article proceeds as follows. First, we provide a brief biography of the entrepreneur, along with essential information about the industry and WECCA's technology. This is followed by a transcript of one of a series of interviews with Cunningham conducted since early 2010. The final section discusses the main findings and limitations of this study, as well as some promising avenues for research.

Biography of the Entrepreneur

Brian Cunningham began his career as a physicist at the

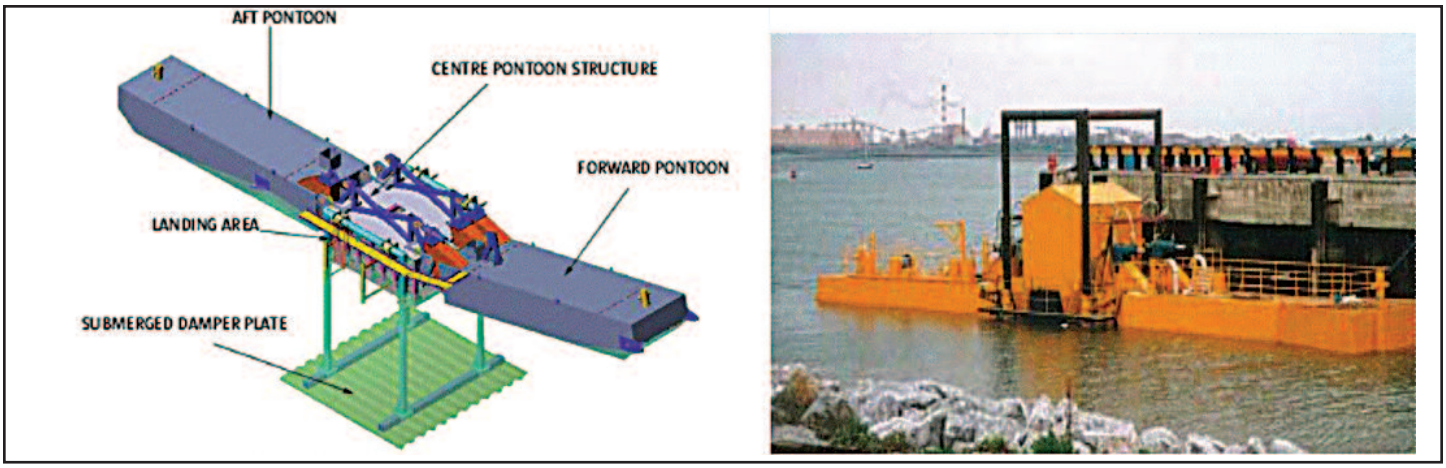


Figure 1. The McCabe Wave Pump
Source: Polaski (2003)

Naval Ordnance Lab, and then became a project manager at the National Aeronautics and Space Administration, where he designed, fabricated and helped launch scientific satellites for America's lunar program. He left the public sector to found the high-tech firm Computer Entry Systems Corporation (CES) in 1968, which went on to design, manufacture, and sell hardware and software for processing bills for such institutions as National Geographic, C&P Telephone, and Riggs National Bank. The firm, which had sales of $78 million in 1987, controlled 40 percent of the niche market known as "remittance processing." As chairman and CEO, he guided CES from its inception through a 12-year private and an 8-year public journey, eventually employing more than 1,000 associates and returning over 30 times the original investment of the founding investors. CES was recognized by both *Forbes* and *Inc*. magazines as one of the fastest growing small companies in the United States, and was increasingly profitable for 16 consecutive years. In 1989, CES was sold to BancTec for $45 million in cash (Walsh, 1988). In 2001, Cunningham founded Entrepreneurial Advocates, Inc. (EAI), a Maryland-based specialized mentoring service for local entrepreneurs, concurrently volunteering with the Entrepreneur-ship Partnership of Greater Washington.

In 2004, Cunningham met Dr. Michael McCormick, a professor at the U.S. Naval Academy, at their 50th high school reunion.[1] McCormick told him about a wave-energy technology he'd been developing in collaboration with civil engineer Peter McCabe (whom McCormick had met at a wave-energy conference back in 1980), which could produce either electricity or potable water (through desalination). Impressed with the comparative simplicity of the design, McCormick designed, built, and tested a model of the so-called "McCabe wave pump" (MWP), the results of which paved the way for a prototyping program. However, while the prototype proved the principle of converting waves to mechanical energy, this energy had not yet been harnessed to produce the marketable commodities of electricity or water.[2] After an investment of several million dollars, the project ran out of money and needed the help of a seasoned executive to get it back on track. Cunningham was thus hired as CEO.

The McCabe Wave Pump

The principle of the MWP is to harness the pitch motion of the waves to produce mechanical energy. The device consists of three pontoons hinged together, aligned with buoys and anchor chains so the MWP faces incoming waves head on (Figure 1). The three pontoons move relative to one another in the waves, but the center inertial pontoon is restricted in its motion by an underwater horizontal plate. Energy is extracted from the rotation about the hinge points by hydraulic pumps mounted at the center. This energy can be used either to create electricity (by driving a generator) or potable water (by pumping water into a reverse osmosis desalinator). Issued in 1992, the original patent focused only on the production of potable water, which was perceived to be the application with the greatest need and value.

In *Water: The Epic Struggle for Wealth, Power and Civilization*, the journalist Steven Solomon argues that water is surpassing oil as the world's scarcest critical resource (National Public Radio 2010). Almost 1 billion people lack access to safe water supplies, but less than 1 percent of the world's fresh water (or about 0.007% of all water on earth) is readily accessible for direct human use. While tapping aquifers provides short-term relief, the long-term solution must include desalination, especially in light of the fact that by 2030, the world will use 40 percent more water than today. Conventional fossil fuel-powered methods for desalination are expensive because they are energy-intensive

(indeed, energy consumption can account for as much as one-third the total cost of the water produced), whereas the MWP could obtain that power for free.

In 1996, a 40m long, 140-kilowatt prototype MWP began testing near Kilbaha in southwest Ireland. However, after several months of operation, the hydraulic pipes burst under pressure from strong waves. Clearly, higher capacity hydraulics was needed, but more importantly, the engineers realized there was enough power in the waves to desalinate seawater directly, without the intermediate step of producing electricity.

McCormick and his colleagues compared the prototype test results with those obtained from computer models of the MWP under theoretical conditions. The test results proved consistent with these models. Specifically, operating in its "design sea" (average wave height of 1.5 meters and an average period of 7.5 seconds), the MWP was calculated to be capable of pumping about 275,000 cubic meters per year of filtered salt water (supply water), or about 750 cubic meters per day (0.0087 cubic meters/second) at an average operational pressure of 70 bar (McCormick 2001). Ongoing sea trials led to further technological refinements. The ocean environment is arduous, and therefore, it was necessary to improve efficiency, robustness, and performance. In 2006, McCormick filed a patent (issued in 2009) for a hydraulic method for increasing the pitching angle of the center barge. Meanwhile, further design changes were made to enable electricity production as well as potable water production, and ensure dependable operation in harsher conditions. It is calculated that in average 2.5m high/8.5 second waves, each unit (now called a "Wave Energy Converter" or WEC) will be capable of supplying 500KW of electricity to the local grid for $0.07-0.09/KWhr.

The oceans of the world contain as much as 10 trillion watts of renewable energy. Europe's accessible wave-energy resource alone is calculated to be about 320,000 MW (megawatt), with the highest resource available near the west coast of Ireland. All of the energy is concentrated near the water surface, making wave power a highly concentrated energy source with much smaller hourly and day-to-day variations than certain other renewable resources, such as wind or solar. Indeed, the energy density of wave energy is 14 times that of wind energy and 8 times that of solar energy.

The next phase of the project is to conduct a quarter-scale model study of the next-generation WEC at the test site provided by Sustainable Energy Ireland (SEI) in Galway Bay, which will produce electricity and potable water. This will pave the way for a full-scale prototype to be deployed at the Irish Wave Energy Demonstration Site off Belmullet, County Mayo, for the purpose of generating up to 12 MWh (megawatt hour)/day. To guarantee financial return for investors in wave-energy projects, the Irish government is offering £220/MWh energy produced for a period of 15 years (this compares to £66/MWh for wind projects). The goal is to meet the soaring demand for energy, while also reducing reliance on costly imported fuels and meeting the European Union emissions mandate (increase the share of renewables in EU energy use to 20% by 2020). Currently renewables make up about 13 percent of Ireland's total energy output.

In late January 2010, Cunningham visited Ireland to meet with government officials, energy suppliers, contractors, venture capitalist, and other parties. Upon his return we conducted the following interview, which had two main objectives: (1) to obtain his assessment of the trip in light of objectives, and (2) to draw out the relevant business principles, so that we may gain new insights into the qualities that set "survivors" apart.

February 2010 Interview with Cunningham

[Note: WECCA was formerly called Ocean Energy Systems (OES)]

Q: Thank you for the opportunity to speak with you about Ocean Energy Systems.[3] We're interested not only in the facts of this case, but also in the underlying business principles—the important lessons learned through experience that our readers can take away and apply in their own careers. You've just returned from an important business trip to Ireland and you gave it a B+. We'd call that "very good." What does "very good" mean in your eyes, and what would a "straight A" have looked like?

Cunningham: To begin with, it's important to realize that any entrepreneur must seek out the pain. Go to where the pain is, and you will have a much higher probability of getting the result you want. For example, Ireland signed both the Kyoto and EU treaties a number of years ago and the Kyoto Treaty particularly calls for them paying fines for excessive emissions beyond 2011. They're 176 percent off what their 1990 emissions were. If they don't get their emissions down, they're going to be paying big fines, and everybody we met in Ireland, from taxi drivers to the minister of energy, told us of the necessity to address this. So I feel we're really going where the pain is. Now let me take you through the trip. Our objectives were fourfold.

First, we wanted to solidify our relationship with Sustainable Energy Ireland. They're the people who are going to put up half of the money for the prototype development, which will begin with a quarter scale model in Galway Bay. And once we pass that, we'll go to Belmullet, where the ocean is heavy, and produce electricity, which will be delivered to the grid. This will all happen over a two- or three-year period—two years for the prototype, and a year or two thereafter to start production of full-scale units. I'm looking for about $5 million in matching funds for the next phase of the

prototype, and a total of $10 to $20 million to make this company entirely profitable on a cash-flow basis. But the first step is to solidify our relationship with Ireland.

The second step was to locate a production crew or company in Ireland that can make the Wave Energy Converters. To qualify for Irish funding, we have to produce the units in Ireland. We found a good candidate in Bear Island Boatyard, because they have the right size dry dock and the right size organization. So, that was the second step.

Thirdly, I needed to find that other 50 percent of the money, and that would come from venture capitalists. And since Ireland is closer to the problem and more committed to the solution, venture capitalists tend to be more interested over there.

And lastly, I wanted to find a customer who was willing to give me a letter of intent to buy power from us at a certain price over a certain period.

Right off the plane, my colleague Dan Morley and I met with Sustainable Energy Ireland at a local hotel. These were the senior people at SEI who were going to carry our application forward to the review committee. We had submitted a preliminary application in October 2009. We were anxious to sit with them face to face, what I call "knee touching," to make sure that we were reading them correctly, and it couldn't have been more cordial and positive. They're very interested in us as a project. They want to do it, and we just have to find somebody to provide the other 50 percent of the investment money required to move us forward with the prototype.

The next thing we did was meet with a potential customer who could buy the power output. The reason for this is simple: if you can show a venture capitalist a customer who's going to buy your product, then you're on much safer ground, because the venture capitalist is trying to constantly reduce his risk. In any event, after we met with Energia, the largest independent energy supplier in Ireland, they agreed to give us a letter of intent to buy all of the power we can produce for 220 euros per MWh. That's $308 dollars in U.S. currency, and we can produce that power, we believe, for about $67 a MWh—that's about 54 euros—so they're going to pay us 220 euros for what we can produce for 54 euros and they'll do it over a period of 15 years, taking all of the energy we can produce. Now, this is subject to terms and conditions as yet undefined, but these should not be hard for us to meet. So we achieved our second objective in getting a letter that we could present to venture capitalists and other investors.

The third thing we did was talk to some venture capitalist firms, and while they didn't commit to invest, they were very interested in our proposition. And if we could meet certain conditions, then they might well invest—conditions that involve tank tests, either in Ireland or the United States, to demonstrate that we could actually produce power. Because even though we've been testing a prototype off the coast of Ireland over a nine-year period, nobody has ever produced either a watt of electricity or an ounce of water, so they wanted to see that could really be done. As a physicist, and that's my background, I am convinced that this can be done, because once you have the energy, you can do with it what you will. Still, some of the venture capitalists are not as technically minded, so they want more tangible proof.

Another venture capitalist firm that we talked to told us: "Look, we're funded by an employment organization here in Ireland and you have to convince them that you can produce the jobs." We can produce an estimated 220 jobs for every hundred WEC units we produce per year. If you do a thousand units, that means you've got a 2,220 people on the payroll. They liked that a lot. But we still have more selling work to do, because we only had a week in Ireland and some of the people we wanted to meet were not available.

The last thing we wanted to do was find a customer to buy actual WEC units from us, as opposed to power. That might well be the Electricity Supply Board in Ireland, who recently announced in Ireland's Independent newspaper there that they are going to put 150 MWs of wave power off the Irish coast by 2020. Well, that gives us enough time, since this is now 2010, to get up and running and it would take 300 of our units to do that, so it's a natural. Our contact at the Electricity Supply Board told us he had no real candidate supplier at present and would love to work with us.

Q: Luke Johnson, who writes about entrepreneurship for the *Financial Times,* recently said that a reliable gut feeling is what separates winners from losers. In fact, he says it's the most valuable emotional tool that any entrepreneur can possess and I wanted to ask you how much weight you put on this "sixth sense."

Cunningham: He's exactly correct. I don't think we're necessarily born with this instinct. You have to make an awful lot of mistakes in order to perfect your ability to pick it up, and as I've said in previous discussions with you, it helps to have made 98 percent of the mistakes one can make in the business world. I can sense how things are going as soon as I go and see a customer. I must address his or her pain as soon as possible, or it's not going to work out for either of us. So again, my answer is to find the pain, and address that pain whether it's in an individual conversation or a sales presentation or whatever.

Q: What implications does this have for our graduates? What advice would you give those considering beginning their own ventures?

Cunningham: I would think they should first prepare a business plan, take it to the market, and let the market beat them

up a bit. Then come back and sort out what direction they should take. But perhaps one of the best sources of advice that they can get is from old veteran entrepreneurs who really enjoy getting back in the fray of things by answering questions for these folks. I didn't have the benefit of mentors. I did have a board of directors, but nobody who really wanted to mentor me, and that was a problem. A mentor can make an unbelievably positive contribution to an entrepreneur's success. They'll take stock for it, or maybe they'll just give the time away to you, because they want to help people, as I do myself. Entrepreneurship is so important. You should understand that 98 percent of net new jobs in the U.S. economy come from companies of 20 or less.

Q: I'd like to turn our attention to commercialization. The success of OES rests largely on a distributive partnership model. Can you explain how that model would work in practice?

Cunningham: The Wave Energy Converters each weigh 160 tons, and as such, should be built in locales where they're going to be deployed. To do that, one needs to have local partners, so I've been out searching for partners all over the world who have dry docks, have a desire to build these units and make a profit off the electricity, the water, or sea salt [byproduct of desalination]. The way the partnership would work is that we would provide technology—both current technology and ongoing technology—in wave energy, and they would do the building on site, supplying jobs to people. They would also deliver and maintain the product at sea. We would get 60 percent of the profits, because we would own 60 percent of the venture, while our local partners would get 40 percent.

Q: The principle here is to make sure that all the parties have skin in the game.

Cunningham: Yes, skin in the game is important to any deal. You can sometimes win without it, but the principle is, get everybody with skin in the game whenever you can. And above all, never give up.

Q: In your business plan you've projected that your joint venture partners will make 17.3 times their original investment, or a compound rate of return of 21 percent over a 15-year period. Some may call that quite optimistic.

Cunningham: Often projections are overly optimistic. In this particular case, we have a government who is committed and is willing to buy all the power we can produce to subsidize companies like Energia at 220 euros a MWh. That's an unusual condition when you have a guaranteed price to be paid over 15 years, so my projections really are much less questionable than is normally the case, because the minister of energy, whom we also met in Ireland during our trip, confirmed that they are willing to do it and he's gone to press with that information. It's not rocket science. It's a matter of good engineering and providing good maintenance and good operations.

Q: You have your projections covered and you have them grounded in some pretty solid facts. One of the other areas of interest to prospective investors would be intellectual property. Can you tell us where things stand on that front?

Cunningham: IP is very important and should be considered by any entrepreneur right up front, because it takes a long time to get a patent—maybe two or three years, but as long as you've applied for one, or been qualified to apply for one, at least you're on the right track. We have applied for two patents, have a third in hand, and after we get funded, we're going to paper our device with patents to protect us and our joint venture partners around the world from theft of the intellectual property.

Q: Looking over your critical agenda, it's very clear that you're thinking strategically. Already, you're thinking about the next phase of financing post-prototype, funding and developing the next generation of wave-energy products, and building a successor team to make OES into a global force in the renewable space. Can you elaborate on the business principle here?

Cunningham: Somebody in the company always has to be looking out 5, 10, and perhaps even 20 years if you want to get to somewhere, similar to getting to a place on a map. You're lost if you don't know where you're going, if you can't point out the place on the map where you're headed, then you can't figure out the alternative means of getting there. Although unlike an actual geographical map, which is pretty constant, ours is a dynamic environment that requires many different kinds of resources—physical, intellectual, emotional and spiritual, as well as financial.

Q: Yes, and at the same time, I think the principle here is that adaptability really must be the mantra of any entrepreneur.

Cunningham: Exactly right. You must provide for adaptability by saying, "What if this happens" or "What if that happens," and "What am I going to do?" You won't be able to predict the exact environment you'll be in, but set your mind to a flexible condition so that you know how to deal with undulations. In fact, some of the greatest inventions of all time have emerged because people have been willing to adapt to situations that were unexpected.

Q: Looking ahead, you intend to diversify from power into water. What's the principle behind this diversification strategy?

Cunningham: Water was the original objective because water is more important to mankind than electricity. Water is the end game and our specific device produces water more efficiently than it does electricity, except for in Ireland and certain other locations. But these are the exceptions. So in a sense, electricity is a diversification taking into account where the market is right now, but eventually it'll come back to water and we will be producing 250,000 gallons per day in one- and half-meter waves.

Q: Water is not the only area you will be venturing into. Sea salt is a byproduct of the desalinization process and is something you've been looking into.

Cunningham: When you desalinate water, 250,000 gallons a day that is, you end up with 50,000 pounds of salt, which I originally thought was something we had to get rid of responsibly. But as I looked into it, I found out that sea salt, unlike mineral salt that you find on land, has a much higher nutrient content. I know a farmer out in Missouri who has a thousand acres and he raises his crops on sea salt, which contains 81 nutrients. I have pictures of sibling pigs, one twice the size of the other, one raised on sea salt, the other raised on PNK—these are the standard elements within fertilizer—potassium, nitrogen, and phosphorus. The world usage of fertilizer is 160 million tons a year. Well, I could produce 50,000 pounds of sea salt every day from one WEC unit. There's a tremendous market for sea salt, not only for agriculture but also direct human consumption. Campbell Soup, as an example, has adopted sea salt because it has these other nutrients in it. So, this was a fall out, a byproduct of our work, but it deserves exhaustive investigation and perhaps even commercialization.

Q: You've talked about the need to gain the support of policymakers and it's clear that you've accomplished that in Ireland. I want to turn our attention to the situation in the United States. Is there the political will here in the United States? I noticed that President Obama recently pledged $8 billion for new nuclear reactors and stressed the need to invest in other carbon-neutral energy technologies, but it seems that wave energy isn't even on the radar here.

Cunningham: You're right. That's a big problem we have. Wave energy is not on anybody's radar screen because I believe that while it's interesting and intriguing, there is no commercially successful industry at this point. There are an awful lot of dabblers out there who are trying to make a go of it, but when they go to raise money like I've been trying to do since 2004 from venture capitalists or foundations or anybody else, they run into obstacles. These people—that is, the suppliers of the money—are responsible to other folks for the money that they have and they don't want to look foolish. When there's no industry out there, they're wondering: 'Even if this company is successful, where are we going to sell the company to get the rich return we deserve for backing this venture?' The industry doesn't yet exist. And I believe it's one of government's jobs to help create industry, so I've been working with SEI in Ireland and they're certainly on to it. They're ahead of me, actually.

Congressman Jay Inslee of Seattle, Washington, has put forth a bill for $250 million a year for 11 years to be spent on the development of wave-energy industry. Once the industry is up and running, we'll all be able to get money a lot more easily, but right now it's very, very difficult. I believe that a rising tide lifts all boats, but with no industry out there, you have no tide to reference, and that's what's made this journey particularly arduous for Ocean Energy Systems. But I have retained the willingness to "never give up" and sooner or later, I'm going to crack this thing.

Q: It doesn't help your case that the information being published about wave energy does not really correspond with the data that you have in hand. The *Wall Street Journal* quoted some data from Bloomberg New Energy Finance saying that as of the fourth quarter of 2009, wave energy is actually the most expensive energy source when you take subsidies out of the equation and I think they were comparing to coal, natural gas, biomass, solar onshore/offshore wind, biomass, geothermal, and some others. They said that wave energy costs between $250 and $500 per MWh to produce, with the likeliest cost being about $375 a MWh. Now, how does that compare with the data that you have in hand? What do you think you can produce it for?

Cunningham: It's the perception that counts. Right now, the world perceives wave energy as too dangerous for us to deal with. We believe that we can produce this energy for $67 a MWh, not $375 as you're suggesting. That's about a fifth of the current estimate. Breaking that barrier and the world will realize that we don't need fossil fuel energy, just as it came to believe it didn't need IBM 360s. But we're going to have to prove it first.

Q: How does your experience working with OES as CEO compare with your experience as a CEO of the public computer company that you built and ran, Computer Entry Systems?

Cunningham: Administratively it's very similar in that you need the best quality of people you can get to do the job. On the other hand, the fundraising has been extremely difficult,

as I said. You might think that a computer company would have more difficulty raising money than a wave-energy company, but that's not the case, because when I began as a fledging entrepreneur, 28 years old, trying to raise money, took my first business plan to Wall Street, at least I was in an industry that existed. IBM and NCR Burroughs and many others were making a lot of money in it, and all I had to do was find some niche application or IP-protected product that would perform 20 percent better than the other offerings. Venture capitalists are easily able to discern whether that's feasible or not, and I won on that basis. But when you don't have an industry to compare against, no reference point that is, it's much harder because they say to themselves, as I said earlier in this interview, even if he does make it, where am I going to sell this company in 5 or 10 years, since there is no industry currently in existence. Remember, these people are out trying to raise money for their next fund and they have to show they were diligent in choosing and managing their existing funds.

Discussion

Cunningham sums up his philosophy this way: "If you can survive, you can thrive." But crucially, he distinguishes between "blind persistence" and "calculated persistence." Blind persistence (persistence for its own sake) may produce results, but only in exceptional cases, and usually with a great deal of luck. Calculated persistence is grounded in sound business judgment, beginning with thoroughly researched and "vetted" business plans and value propositions. For example, all the persistence in the world is unlikely to bear fruit unless the entrepreneur "goes where the pain is greatest" (i.e. where there is a demonstrable market need for the product or service and where funds are available to pay for the proposed solution). Similarly, persistence in fundraising is far more likely to produce results if market-sensitive investors can be shown something more than just a good idea. Proof of concept (however preliminary) and a letter of intent from a customer helps, as does a clear and compelling strategy and exit strategy. At the same time, reasonable flexibility is a must. Driving a singular view of strategy out of sheer stubbornness is a recipe for disaster. Also, cultivating enduring business relationships takes more than persistent effort: business partners must also be properly managed and incentivized.

Importantly, says Cunningham, calculated persistence is not just a matter of analysis, but also reliable gut feeling, built up through years of commercial experience. As Johnson (2010) pointed out, at critical points in the life of a venture, decisions have to be taken without all the facts on hand. Combined with the confidence that comes with a successful track record, this "sixth sense" enables the entrepreneur to carry others with them, even though they cannot necessarily provide concrete evidence that they are right. "If you are to launch projects before others, invent new products or seize opportunities ahead of the pack," says Johnson, "you must be willing to act—at least in part—on a hunch." In situations where a team lacks the requisite first-hand experience, deficiencies can be offset in large part by bringing in the right partners and mentors. A number of studies have confirmed the value of mentorship in entrepreneurship (see for example Sullivan, 2000; Cull, 2006; Deakins et al. 1997; Taylor et al. 2004; Bisk, 2002). Cunningham would argue that even the most experienced entrepreneurs need mentors of their own, whose job is to challenge assumptions systematically through "constructive dissention," forcing the entrepreneur to think properly through their decisions.

At the time of writing, Cunningham's company remains stuck in the Valley of Death, although he is upbeat about its near-term prospects for funding. Further interviews with Cunningham may yield hypotheses about the relationship between persistence and survival in entrepreneurship that may be tested in larger scale longitudinal studies involving multiple entrepreneurs. Additional research is required to identify the elements of calculated persistence (analytical, intuitive, other), where they reside (executive team, board of directors, professional firms, financiers, and so on), and how they are best assembled in a new firm. Also of interest is the relationship between "calculated persistence" and "performance persistence" (the idea that success breeds success). According to Gompers and Lerner, entrepreneurs with a successful track record had a 34 percent chance of succeeding in their next venture-backed firm, compared with 23 percent for those who previously failed and 22 percent for first-timers. Common sense would suggest that calculated persistence and performance persistence are related.

Conclusion

Ninety percent of new entrepreneurial businesses that are not able to attract venture capital fail within three years. Drawing on an in-depth interview with a seasoned entrepreneur, this exploratory study lends further support to the widely held, but largely unsubstantiated, view that persistence is vital to entrepreneurial survival. The study also revealed a potentially useful distinction between "blind" persistence (persistence on principle) and "calculated persistence" (persistence grounded in sound business judgment). The latter has two components: analytical (starting with a thoroughly researched and vetted business plan), and intuitive (a sixth sense built up over years of in-the-trenches commercial experience). Further research is needed to understand the nature of calculated persistence, as well as its relationship with performance persistence—the notion that entrepreneurs who have at least one successful venture-backed company under their belt are more likely to succeed in their next venture-backed firm.

Endnotes

1. McCormick's experience in wave-energy conversion dates back to 1973, when he was the U.S. Coast Guard Research Professor at the U.S. Naval Academy, studying oscillating water-column wave-energy conversion. Appointed the Corbin A. McNeill Professor of Naval Engineering in 2007, he is the author of *Ocean Energy Mechanics* (Cambridge University Press, 2009).
2. It is useful to distinguish between *energy density* (how much energy the waves can carry), *energy conversion efficiency* (how much usable energy can be harvested from the waves with a technology such as the MWP), and *embodied energy* (what it costs to harvest, transform, and distribute this energy to its point of use). The latter two have yet to be demonstrated.
3. Since this interview took place, the venture split into two divisions: Ocean Energy Systems is now solely concerned with potable water production; WECCA focuses exclusively on electricity production.

References

Bisk, L. 2002. Formal entrepreneurial mentoring: the efficacy of third party managed programs. *Career Development International* 7(5), 262–270.

Cull, J. 2006. Mentoring young entrepreneurs: what leads to success? *International Journal of Evidence Based Coaching and Mentoring* 4 (2), 8–18.

Deakins, D., L. Graham, R. Sullivan, and G. Whittam. 1997. New venture support: An analysis of mentoring support for new and early stage entrepreneurs. *Journal of Small Business and Enterprise Development* 5(2), 151–161.

Gelles, D., and R. Waters. 2010. Clean technology start-up investment proves renewable. *Financial Times*, April 3, 9.

Gompers, P.A., and J. Lerner. 2001. *The money of invention—how venture capital creates new wealth.* Boston, MA: Harvard Business School Press.

Johnson, L. 2010. A good gut feeling is the secret weapon. Retrieved December 2, 2010, from *Financial Times*, http://www.ft.com/cms/s/0/375ced54-2664-11df-aff3-00144feabdc0.html.

McCormick, M. 2001. Wave-powered reverse-Osmosis desalination. *Sea Technology*, December. Retrieved February 18, 2010, from http://findarticles.com/p/articles/mi_qa5367/is_200112/ai_n21482137/?tag=content;col1.

National Public Radio (2010). *Will the next war be fought over water?* All things considered, January 3. Retrieved February 18, 2010, from http://www.npr.org/templates/story/story.php?storyId=122195532.

Polaski, K. 2003. Waiting for the Waves. *The IEA Ocean Energy Systems Newsletter*, Issue 2, September. Retrieved February 18, 2010, from http://www.iea-oceans.org/newsletters/news2.pdf.

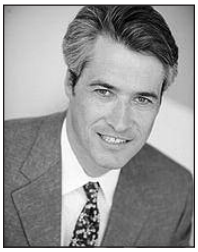
Sullivan, S. 2000. Entrepreneurial learning and mentoring. *International Journal of Entrepreneurial Behaviour & Research* 6(3), 160–175.

Taylor, D.W., O. Jones and K. Boles. 2004. Building social capital through action learning: An insight into the entrepreneur. *Education + Training* 46(5), 226–235.

Walsh, S. 1998. Dallas Firm to Acquire Computer Entry Systems; BancTec to Pay $45 million for Md. company. *The Washington Post,* December 13, 8.

Wu, S., L. Matthews, and G. K. Dagher. 2007. Need for achievement, business goals, and entrepreneurial persistence. *Management Research News* 30(12), 928–941.

About the Authors



Giles Jackson (gjackson@su.edu) is Associate Professor, Director of Internships, and Division Chair at the Harry F. Byrd, Jr. School of Business, Shenandoah University. He has worked closely with Brian Cunningham for two decades, initially as a research analyst with Entrepreneurial Advocates Inc., and now as an advisor to the Wave Energy Conversion Corporation of America.

Randy Boxx (rboxx@su.edu) is Dean and George Edward Durell Chair of Management of the Harry F. Byrd, Jr. School of Business at Shenandoah University.